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EDITORS' OUTLOOK

Would higher priced chemistry teachers produce greater wealth, health, and safety in this country? Let us consider this question for a moment.

Experience of the ages has clearly shown us that chemistry is our principal hope in our great fight against disease, but our chemists are entirely inadequate as shown by the diseases' continual ravishments. Bright little lives as well as those older are being constantly taken from us while the doctors stand by completely helpless, waiting for some chemist to solve the problem by a systematic research. It is only *great* chemists who can help the doctor cope with these vital situations.

One has only to look on every hand to see what the chemist can do for the wealth of a nation. His work has been so great that the poor live today in as much luxury as did the king one hundred years ago. The chemists' contributions toward civilization have been most pronounced. To illustrate by a sample case take the chemists' contribution to the metals. Were this contribution withdrawn, the entire structure of civilization would collapse. There would be no railroads, steamships, automobiles, telephones, telegraphs, steel bridges, stoves, steam boilers, etc. These achievements have been made possible by the hands and minds of *great* chemists.

The World War brought home to each of us the place of the chemist in the safety of our country. The Germans are quite ready to acknowledge that the chemists saved her from an early defeat, both in the military field and in the matter of economic supplies. Had it not been for Haber, Ostwald and other great chemists, the war would have ended in 1915 from the exhaustion of Germany's supplies of nitrate, both from a lack of nitrate explosives and nitrate and ammonia fertilizers. During the World War all

other nations were equally subservient to chemistry. When one takes occasion to review the intricate problems confronting the nation during and at the close of the war, we are forced to see the wisdom of producing *greater* chemists.

Since there is an increasing demand for *great* chemists in solving vital problems connected with health, wealth and safety of this nation, we must carefully consider their production. Can we expect a great chemist to be produced by a poorly trained and poorly paid teacher? Should there not be a demand that all chemistry teachers be well trained, and then in turn that they receive a wage commensurable with the importance of their work and training. If the advancement of health, wealth and safety in the country could be improved by increasing the salary of the chemistry teacher, would not the payment of better salaries be an excellent investment?

N. E. G.

The following papers have been accepted and will be published as soon as space permits.

"A Method for the Calculation of Some Quantitative Problems." A. J. Hopkins.

"Chemistry as Depicted in Art." Adeline H. Jacobs.

"The Place of Analytical Chemistry in Agriculture." Henry R. Kraybill.

"Should Teachers Do Research or Commercial Work?" C. C. Hedges.

"A Demonstration Experiment of Electrolytic Oxidation and Reduction." C. E. White.

MOVIES IN THE SERVICE OF SCIENCE

BY ELMER O. KRAEMER, UNIVERSITY OF WISCONSIN, MADISON, WIS.

A number of inquiries have been received as to the possibility of renting or purchasing copies of the film on Brownian motion and other ultramicroscopic processes shown to the Second Colloid Symposium at Northwestern University and to the Fall meeting of the American Chemical Society at Ithaca. If the response to this announcement is sufficient, a special film will be prepared, copies of which will be for sale to educational institutions at cost (not more than 10 cents per foot).

The film should be of interest to a wide variety of students, from the high school student of physics desiring a concrete idea of the nature of gases and liquids on the basis of the kinetic theory, to the specialist in colloid chemistry. The film demonstrates among other things, the continual, unordered motion (Brownian movements) of small particles subjected to molecular bombardment by the surrounding liquid, and the superposition of this motion upon the uniform translatory motion of a particle falling slowly under the influence of gravity. The Brownian movements give not only rather convincing evidence for the existence and reality of molecules, but also a satisfactory picture of the mechanics underlying the kinetic theory of matter. They furnish an image or prototype of such molecular processes and concepts as osmosis and osmotic pressure, diffusion, equipartition of energy, etc.

Beyond the qualitative aspect, the Brownian movements furnish most direct quantitative confirmation of many predictions of the theory of probabilities and the kinetic theory based thereon. The Maxwellian distribution of molecular velocities and the Gaussian distribution of molecular displacements are both illustrated. As a result of the Brownian movements, the number of particles in a microscopically small volume (as well as the molecules in a gas) continually and spontaneously fluctuates about the average number or concentration. These spontaneous fluctuations demonstrate the invalidity of the classical statement of the second law of thermodynamics as applied to micro-systems, and reveal a suitable statistical basis for a more adequate formulation of this law.

The film also records processes which are more chemical in character. Thus there is included the formation and breakdown of a jelly as revealed by the motions of foreign particles imbedded in the jelly. The coagulation of a colloidal solution has also been filmed. The collision and union of particles to form larger and larger aggregates is shown in considerable detail. The formation of a new phase yielding a colloidal solution has likewise been recorded.

The film will contain brief titles explaining the simpler and more qualitative aspects of the subjects. The demonstrator need not go into the more

interesting, but at the same time, more involved details unless he so desires and the spectators may profit thereby. With very brief titles, the film will probably total about 600 feet (10 minutes).

Those interested in renting or buying this film should communicate with Elmer O. Kraemer, Chemistry Department, University of Wisconsin, Madison, Wisconsin. An expression of preferences for long or short titles and legends would be appreciated. They will then be prepared to satisfy the majority of users.

ORGANIZATION OF CHEMISTRY TEACHERS

Since the last issue of THIS JOURNAL a number of inquiries have been received relative to the best method of organizing chemistry teachers. In view of this the New England Association of Chemistry Teachers was requested to give briefly the experience of their Association and also its constitution. The request was granted through the courtesy of its president, S. W. Hoyt. Dr. Lyman C. Newell, who was its first president, and who is now curator of the Association, was delegated to give the requested information. He says in part:

The New England Association of Chemistry Teachers was started in 1898. The first members were teachers of chemistry in and around Boston. They were largely high school teachers, though the Association has always had the support of a number of teachers of chemistry in colleges. At the beginning, conservatism was the watch word and hence membership was restricted to a rather small number. It was soon found, however, that interest in teaching chemistry and need of help were greater than was anticipated. In view of this the restrictions were gradually removed, and the membership today is about 400.

A simple constitution and by-laws were adopted. These are given below. As our needs grew, changes were made, but the organization has been kept as simple as possible. Two classes of members were provided—active and associate. The active membership is made up of teachers who can attend meetings and wish to share in the administration of the organization. The associate membership consists of those who are willing to forego the privilege of holding office, being teachers, as a rule, who live too far from the places where meetings are held. The dues were made very moderate at the start and have been kept so ever since. Associate members pay smaller dues than active members. Three or more meetings have been held every year since the Association started. Beginning with the third meeting, reports have been printed and sent to each member. As soon as the organization was well started, these reports were made as full as possible so that all members, especially those unable to attend the meetings, could get the benefit of the papers, etc. Some of these reports contain material especially valuable to teachers of chemistry. A few are quite long, for example, the report of the twenty-fifth anniversary meeting, was nearly sixty pages.

From the very first the meetings were planned to help teachers of chemistry. A large number of topics relating to high school chemistry have been considered and some of them many times, especially topics giving trouble or topics relating to advances in chemistry. New books have been reviewed and new apparatus displayed at most of the meetings. Another feature has been the performance of simple experiments which members have found useful in their own classes. Still another feature has been visits to

industrial plants. Every chemical plant of importance in Boston and vicinity has been visited. Several times visits have been arranged to plants in and around New York City. As a sort of supplement to these visits, men engaged in industrial chemistry have read papers at the meetings.

The meetings are held on Saturday at high schools, especially in new buildings where the equipment can be examined at leisure, or in special buildings where moving pictures can be shown or where an inexpensive luncheon can be served through the coöperation of the domestic science department. In this connection it ought to be stated that the officers plan meetings to keep the expense to members as low as possible. The management has always been in the hands of efficient men and women, and until the last few years was rather simple. The recent rapid growth, however, made a reorganization necessary, so the Association was divided into groups located at strategic points in New England. Each group has a chairman and other officers, and meetings are held under the direction of these groups in addition to the regular meetings which are held in and around Boston as formerly.

The Association is unique in being, as far as I know, the only organization of high school and college teachers which has held meetings without interruption for a quarter of a century.

A copy of the constitution may be suggestful to other teachers who are anticipating a similar organization.

Constitution of the New England Association of Chemistry Teachers

ARTICLE I.—NAME

This organization shall be known as the New England Association of Chemistry Teachers.

ARTICLE II.—OBJECT

The object of this Association shall be to promote efficiency in the teaching of chemistry.

ARTICLE III.—MEMBERSHIP

Section 1.—Any person interested in the teaching of chemistry is eligible to membership.

Section 2.—Members shall be of three kinds: active, associate and honorary.

Section 3.—The numbers of members, active, associate and honorary, shall be unlimited.

Section 4.—Nominations for membership of all kinds must be made through the Executive Committee who may refuse to propose the name of any candidate.

Section 5.—All persons nominated by the Executive Committee shall be voted upon by ballot.

Section 6.—Associate and honorary members shall not vote or hold office, but shall have all the other privileges of the Association.

Honorary members who pay annual dues of three dollars shall be classed also as active members.

ARTICLE IV.—DUES

Section 1.—Annual dues of active members shall be three dollars, and of associate members, one and a half dollars. Honorary members shall be exempt from all dues.

Section 2.—Members one year in arrears shall forfeit membership at the discretion of the Executive Committee.

ARTICLE V.—OFFICERS

Section 1.—The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, Assistant Secretary and Curator, whose duties shall be those regularly performed by such officers.

Section 2.—The officers shall be chosen by ballot at the November meeting, and a majority of all votes cast shall be necessary for election.

ARTICLE VI.—ORGANIZATION

Section 1.—The membership of this Association shall be divided into regional groups called divisions as follows: The Central Division, to include Massachusetts east of a north and south line through Palmer, and exclusive of Bristol County, Massachusetts; The Southern Division, to include Rhode Island and Bristol County, Massachusetts; The Western Division, to include Connecticut and Western Massachusetts; and the Northern Division, to include Maine, New Hampshire and Vermont.

Section 2.—The above divisions may be subdivided at the discretion of the Executive Committee.

Section 3.—The activities of each regional group shall be in charge of the division chairman, who shall coöperate with the officers in carrying on the work of the Association in his group.

Section 4.—The Division Chairman shall be elected at the same meeting as the officers of the Association.

ARTICLE VII.—COMMITTEES

Section 1.—The Executive Committee shall consist of the six officers and the division chairmen.

Section 2.—Committees may be appointed by the Executive Committee at their discretion, or by the Association at any regular meeting.

Section 3.—The Executive Committee shall have full power to transact all business of the Association not otherwise provided for by the constitution.

ARTICLE VIII.—MEETINGS

Section 1.—Fifteen members shall constitute a quorum.

Section 2.—This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided notice of such amendment has been given in writing at the meeting preceding, and the amendment shall be ratified by each group having regular regional activity.

LYMAN C. NEWELL, *Curator*

The Maryland Association of chemistry teachers has a similar constitution except its *object* has been broadened. It reads thus:

The purpose of this Association shall be to promote efficiency in the teaching of chemistry. More specifically, the Association shall seek to accomplish this purpose by serving as a medium for the exchange of ideas on practical teaching problems and as a means for keeping teachers in touch with the broader aspects of chemical education, particularly by affiliation with the Division of Chemical Education of the American Chemical Society.

The other method of organization in connection with the Local Sections of the American Chemical Society as outlined by the constitution of the Division of Chemical Education has not become standardized. At the

present time a number of the Local Sections have appointed a committee to bring in recommendations on the project. It is hoped that announcements of their recommendations may be given in the next issue of THIS JOURNAL.

A PROMISING FIELD OF CHEMICAL EDUCATION*

BY HARRISON HALE, UNIVERSITY OF ARKANSAS, FAYETTEVILLE, ARK.

For the past three years there has been offered at the University of Arkansas, both during the regular term and in the summer, a course in "American Chemistry," with the purpose of showing "what Chemistry is doing for America, and what America is doing for Chemistry."

There is no prerequisite for the summer course which is given one hour a day during a six weeks term. The interest in this course shown by a number of women who had not studied chemistry suggested its use in the study courses of Women's Clubs under the direction of the General Extension Division of the University. It was felt to be more than probable that no club would register for this work, especially as previous announcements had contained no courses on scientific subjects. Woman's supposed aversion to science in general and to chemistry in particular was proverbial.

With decided hesitation, then, this announcement was placed in the Bulletin of the General Extension Division of courses for Women's Clubs in in the spring of 1923.

"There has been a general movement in recent years to make the science of chemistry, which so strongly influences our everyday home and national life, understandable to those outside the field of research and production. The course mentioned below is non-technical, designed to give that newness of vision and awakening of interests which result from a knowledge of what this all-important science is doing and may do for us.

"American Chemistry: (1) Chemistry—the Ball-Bearings of Progress, (2) In Peace and in War, (3) Water, Sanitation and Medicine, (4) Feeding the Family, (5) Clothing the Family, (6) Painting the Picture of Progress, (7) Fuel for Fire and for Force, (8) Dinner Plates and Drain Pipes, (9) Rubber, (10) Electro-chemistry and the Kitchen, (11) Gold, King of Metals and Iron, the President (12) American Chemistry and the Future."

The results surprised us. Of the twenty courses offered for club study only four enrolled more clubs; they are as follows: Men and Women of Achievement, 9; Citizenship, 8; Current History, 6; American Literature, 5; American Chemistry, 4.

A course of lessons was prepared and reference texts given. As the work progressed, as much contact as possible was maintained by letters and by

* Read in the Division of Chemical Education of the American Chemical Society at the Washington Meeting, April 24, 1924.

furnishing additional material upon request. The use of material in the magazines and in the newspapers was encouraged. Two of the clubs were visited. Interest in the course is reported from "usual" to "more than usual." Some of the clubs invited men of technical ability to speak to them. Thus, the club at Malvern heard the superintendent of the American Bauxite Company. A number of women, whose influence is decidedly worth while, have been interested in the importance of chemistry, and the knowledge gained has been of value to them. The voluntary choice of this course by these women shows an appreciation of the fundamental value of chemistry in American life. Further work along this line with women's clubs offers a most promising field of chemical education.

In response to a request for suggestions to be incorporated in this paper, Mrs. John Dickenson Sherman of the General Federation of Women's Clubs, sent the author the following:

"As the proposed paper is to include a report on the study of American Chemistry by Arkansas women's clubs, with its possible application to other states, would not the case be strengthened by incorporating the attached announcement issued jointly by the Department of Applied Education, of which I am chairman, and the Department of Public Welfare presided over by Mrs. Blair? This announcement has gone to individual clubs in every state in the Union, putting further emphasis by the General Federation of Women's Clubs on the importance of chemistry to women's activities and interests, and rendering public thought still more receptive to its responsibility for coherent support and effective recognition of scientific research.

"It will be very helpful in developing and directing the interest, if you will urge the chemists, especially those connected with educational institutions to let officers of nearby clubs know when any researches have a bearing upon the projects which such clubs are promoting. The women who are charged with the duty of preparing programs for the year's study, need the help of chemists when chemistry's bearing upon human welfare is to have a place in the programs. The scientific men in the institutions which the sons and daughters of the clubwomen are attending, are best fitted to render this help. If you will emphasize and amplify these facts in your paper it will be very helpful."

The announcement referred to above is as follows:

"The departments of Applied Education and of Public Welfare are coöperating in the issuance of a series of programs on subjects whose intimate relation to important activities in both departments have been revealed or emphasized by recent chemical and other scientific researches.

"These researches are throwing new and wonderful light upon old subjects, showing new ways of achieving long standing objectives of Federation effort. Some of the achievements in Creative Chemistry were touched upon by Mr. Francis P. Garvan, President of the Chemical Foundation, in his address at our last Biennial. Others were discussed in the 'Plea to American Women,' signed by Mrs. Winter and by the heads of four other national organizations and sent to all clubs in the General Federation.

"This announcement is in line with the burden of that plea that 'we assess anew the value of the intimate and unending service of chemistry to home, community and country.' Because of the double bearing of these scientific achievements, the chairmen of Applied Education and of Public Welfare, with the hearty approval of the General Federation President, are seeking to double results by issuing joint study programs on

such subjects as: (1) material thrift and physical thriving, (2) coal conservation and the country's medicine chest, (3) scenic beauty and public health, (4) nitrogen—its role in wealth and health, in peace and peril, (5) the promotion of chemical research and the conservation of public health. Programs with references and literature on these and other kindred subjects having a dual relation will be issued from time to time and amplified upon request to either chairman."

Secretarial Note.—As a result of the discussion aroused by this paper, it was voted that the members of the Division of Chemical Education express their thanks to Mrs. Sherman and approve her idea of activity of women's clubs along chemical lines. It was further voted that the chairman appoint a committee to take up the matter of the study of chemistry by women's clubs.

THE ADVANTAGES OF LABORATORY WORK IN THE STUDY OF ELEMENTARY CHEMISTRY

W. G. BOWERS, STATE TEACHERS COLLEGE, GREELEY, COLO.

General observations may be responsible for arousing curiosity leading to investigations for general truths, and physical observations may be responsible for arousing chemical observation, but physical observations are not so liable to cultivate chemical observation. The fact that our knowledge of chemical truths took its inception long after physical observations began, and has multiplied like disease germs, is proof of this. It would be putting it conservatively to say that, on the average, one fact learned in the chemical laboratory leads to four guesses, two of which lead to subsequent facts. We could not account for this by any other means than by granting that the laboratory cultivates curiosity.

Affords Observation.—F. S. Kedzie, School Science and Mathematics 5:309, says that the student does not learn truth from statements made by the teacher but by observations of his own. Observations in chemistry generally come only after a purposeful and diligent search. The observation which thrusts itself upon the casual observer is in most cases, at least, not a chemical observation. If we compare the chemical explorer with the forestry explorer, the sight of a new physical demonstration might thrust itself upon the chemistry student, as the sight of a new kind of tree would upon the forestry student. But if the chemistry student wished to observe the chemistry underlying the physical demonstration, he would have to use his tools to uncover the hidden roots just as the forester would have to use his tools to dig the earth from about the roots of the tree.

Any one who has ever studied mathematics will realize how much easier it is for the student to see how the instructor solved the problem and got the answer than it is for the student to get it himself. The experiment in chemistry works in a similar way. It is easy for the student to see how the instructor gets results, but the student has to use his own hands and

work the thing out for himself in order to observe the thing in its details. Any chemistry student can remember how easy it looked to see the instructor place a couple of solutions in one test-tube, then one solution in another, then pour from one test-tube into the other and get the brown ring and from that conclude that there was a nitrate in one of the tubes. But he will also remember his own disappointment when he took a known nitrate and treated it with the mixed reagents. He will recall, too, his astonishment at the number of conditions which would fail to produce the desired results in this simple experiment.

Jesse Coplin says that laboratory work is for the purpose of giving training in observation. This should be interpreted to mean a passing from observations to deeper scientific thinking.

Cultivates Observation.—Dr. Charles Eliot with Prof. F. H. Storer, designed the first laboratory manual used in the United States and England. Dr. Eliot said that it was designed for the purpose of developing observation on the part of the student.

When a student runs a known compound through a series of tests in order to enable himself to identify the metal of that compound in other combinations in the future tests, he is seldom careless as to whether he is going to be successful or not when he is given an unknown, but he desires to be able to give a correct report on the unknown the first time. He therefore cultivates close and accurate observation and lets nothing escape, which may have a bearing on the differentiation of that element from others of its group. And when he does make a mistake as to identity, he wonders why and watches still more carefully in the next test until he gets the correct identification. And in the next unknown his soul is literally set on making observations so thorough that he will not have to repeat the test.

Dr. Chas. Eliot says: "The need of laboratory work is to train observation. In olden times they got it through hardships. Now they need it because memory work is emphasized too much and scientific observation not enough. The laboratories give men of remarkable capacities opportunities to develop them. Before laboratories were established, men studying to become physicians were at the foot of the class because language and literature were not their fortes." Dr. Eliot observed in 1906 that in the last twenty years men studying to become physicians were at the head of the class because laboratory work and observation were most important in their course.

Brings Information.—To say that laboratory work brings information to the student, would be stating a truth, but perhaps it would be making the most insignificant claim for laboratory work that could be made. Obviously there are certain types of information that can be obtained in no other way. First hand information has to come by one or the other of two processes, one in which nature governs the conditions and the other

in which the experimenter governs them. It is true that nature furnishes even more varied conditions than can be brought about by an experimenter, but nature does not tell us the weight, to the thousandth of a milligram, of the substance before and after the chemical change. Nature may tell us that temperature is involved but does not tell us to the tenth of a degree centigrade. Nature may tell us that gases result from certain solids, but it does not give us even the crudest measure of the volume of those gases and may not give us a means of distinguishing poisonous gases from non-poisonous ones until it is too late.

Fastens Information.—We would be justified in concluding that any laboratory exercise which has a place in the laboratory course only for the sake of conveying second-hand information might better be stricken from the list. But conveying information is not all that should be considered in connection with information. The retention of information in such a way that it can be used in further study is very important. The information brought by real contact with things is remembered much easier. This phase of the subject is important, but of more importance still are the associations connected with the piece of information. These associations immediately cluster about the main idea, if obtained by a laboratory exercise, in such a manner that it gives it an advantage in its use in further study.

Whether the information remains in the memory longer, if obtained by laboratory work, than if obtained from the text, is still a question. In order to test this, we would have to be able to separate some portions of the work into two parts: One part of which has been given by means of the textbook, the other given by means of the laboratory only. This sort of work is seldom done in elementary chemistry. However, we can make two divisions, one of work done by textbook alone and another done by text and laboratory.

In order to see if the information supplemented by laboratory work lasted longer than that not so supplemented, we gave a set of examinations to a number of our students who had had their elementary chemistry one year previous to the examination, and the same set of examinations to a number of students who had had their elementary chemistry two to six years before they took the examination. The examination consisted of ten questions from the textbook, which could not be answered in terms of information obtained from laboratory work which we had given them, and ten questions from laboratory and text work. In the case of the latter, we asked the students to state if their answers depended on their memory of the laboratory work.

List I, Those taken from the theoretical part of the work, and having no connection with laboratory work of any kind.

The questions given are as follows:

1. What is meant by the term absolute zero?

2. What is the difference between an atom and a molecule?
3. What is a theory?
4. Define atomic weight.
5. What is the difference between an atom and an ion?
6. State Avogadro's Hypothesis.
7. Make a diagram of a device used in making lampblack.
8. Name the members of the Halogen Family.
9. Make a diagram of a device used in purifying sulfur.
10. State the Law of Mass Action.

List II, Questions taken from the part of the work studied in the laboratory as well as in the text.

1. What is the difference between a mixture and a compound?
2. How can chlorine be prepared?
3. How can nitric acid be prepared?
4. What class of solutions ionize, what class does not?
5. How can amorphous sulphur be made?
6. Give the chemical properties of arsenic.
7. Make a diagram of a gas burner flame, naming the regions.
8. What are the chemical properties of hydrogen?
9. Draw a diagram of an apparatus for testing vapor pressure.
10. Give the chemical properties of carbon monoxide.

The following table shows the results of these examinations.

Years since work taken	Text grade	Laboratory grade
1	60	78
1	70	75
1/2	50	75
1	50	90
1	83	73
1/2	50	50
1	80	93
1	98	93
1	82	85
Average	70.8	80.2

Years since work taken	Text grade	Laboratory grade
2	60	60
2	40	70
2	40	65
2	45	60
2	50	70
2	47	65
2	45	60
2	50	45
2	50	65
2	40	40
Average	46.7	60.0

Years since work taken	Text grade	Laboratory grade
3	30	70
3	43	60
3	52	75
3	70	90
4	25	60
6	45	40
Average	44.2	65.8

It will be noted in the accompanying table that those students who had their elementary chemistry one year before the examination averaged 70.8 per cent in the text work and 80.2 per cent in their laboratory work. This gives 9.4 per cent difference in favor of the laboratory work. The students who finished their work two years before the examination made an average of 46.7 per cent in the text work and 60 per cent in the laboratory work; 13.3 per cent in favor of the laboratory work. The students who had been out of the work for three or more years, made an average of 44.2 per cent in the text work and 65.8 per cent in the laboratory work, 21.6 per cent in favor of the laboratory.

It will be noticed that the difference in favor of the laboratory grows larger as the years increase, showing that laboratory work fastens the information better than does the work in the text.

A NEW COVERING FOR LABORATORY TABLE TOPS*

B. S. HOPKINS, UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS

Every laboratory is sooner or later confronted with the problem of replacing or resurfacing its laboratory tables. During the past year we have tried out under various conditions a new material which has given splendid satisfaction. Since Professor Hoover[1] in his excellent discussion on "Laboratory Table-Top Materials" does not mention a coating of this sort, it is assumed that other laboratories may be interested in knowing the results of our experiments.

The material is a plastic which is sold[2] under the trade name of "rezilite." According to the description furnished by its manufacturers it contains a mixture of five inert bitumens of which the principal ingredient is mineral caoutchouc. Gilsonite manjack, petroleum asphalt and other materials are mixed together and heated until the mass becomes uniform. After cooling a volatile oil and a large per cent of asbestos fibre are added and the mixture churned until a uniform rubber-like paste is formed. The rezilite is easily molded into any form, may be worked around pipes and spread upon a floor or table top when it hardens giving a resilient and permanent coating. Rezilite is shipped in barrels and may be kept indefinitely. It is obtainable in the natural black color or tinted red, brown, olive green, deep green, tan or gray.

Before applying rezilite to old laboratory tables the surface should be thoroughly scraped to remove as completely as possible the chemicals which

* Read before the Division of Chemical Education at Washington Meeting of the American Chemical Society, April 24, 1924.

[1] C. R. Hoover, *Ind. & Eng. Chem.*, **15**, 569 (1923).

[2] Rezilite Manufacturing Company, Peoples Gas Building, 122 So. Michigan Avenue, Chicago, Illinois.

have badly disintegrated the original material. If holes have been burned in the tops, these should be patched by the carpenter or chiseled out and filled with cement. Large cracks should be filled in a similar manner and warped boards planed to a relatively smooth surface. In preparing a wooden table top for the rezilite coat, it is sometimes wise to nail on the edge a thin moulding projecting about 1/4" above the level of the table. The final coat is made flush with the top of the moulding. Generally, however, we have found it better to omit the moulding and apply the rezilite in such a manner that it forms a continuous coat over the top and the edge of the table. Rezilite may be applied to almost any surface—wood, metal, concrete, stone, etc.

In applying rezilite at least three coats are used. The first is a priming coat which is applied with a brush. When this has dried the main coat, which is generally the black rezilite, is applied and rubbed out to a fairly smooth surface with a plasterer's trowel. After this has hardened the finish coat of the desired color is applied with the trowel. Two coats of finish may be used if desired. After the final coat has set the material may be given a smooth finish by softening the surface with gasoline and then rubbing to the desired smoothness with the trowel. As a final finish we have sometimes used "lacquerall"[1] which produces a polish resembling a varnished surface.

While the tables are in use they are easily cared for. If the surface is smooth simple washing with a sponge or towel is sufficient to keep them in good condition. Two or three times a year they should be thoroughly cleaned with a rag dampened with gasoline. Occasionally the surface may be refinished by thoroughly wetting with gasoline and smoothing off with the trowel; or if desired a thin layer of the finishing coat may be applied at any time. Repairs are easily made. Cracks may be filled with the finishing coat and if blisters or defects appear they may be chiseled out and new material added easily.

The advantages to be gained in the use of this material are, that it is not attacked by either acid or alkali reagents;[2] it is water proof, fire resisting, is never slippery, is resilient, is quickly applied, easily repaired and long lived. The floor of our main lecture room has been covered with this material for about eight years and in spite of the tremenduously heavy wear which it has received there is no indication of wearing out.

The material has a few disadvantages, however. Its tendency to shrink as it hardens develops cracks; long continued heating will soften a thick layer of rezilite sufficiently to permit a heavy piece of apparatus to sink

[1] Sold as "No. 2 Universal Paint Solvent," by the Flint Paint and Varnish Corporation, 425 Detroit Street, Flint, Michigan.

[2] The black, brown and red are somewhat more resistant to the corrosion of heavy chemicals than the other colors.

into it but these defects are easily repaired. The most serious difficulty which we have encountered with rezilite comes from the use of laboratory reagents which are good solvents for bitumen. It has not been satisfactory as a table-covering in the organic laboratory.

The cost varies widely with the amount of surface to be covered, and the way in which the work is done. In our first job a heavy coating was used and the application made by workmen sent here from Chicago. The cost was about 40 cents per square foot which is less than new wooden table tops would have cost. More recently our laboratory handy man has done the work and a very thin layer of rezilite has been used. In this way the cost for material has been in the vicinity of five cents per square foot and the labor has not exceeded three or four cents.

In addition to its use as a covering for laboratory table tops and floors we have found rezilite an exceedingly useful material for stopping leaks in sinks and around pipes in the floor. It is now proposed to use it as a protective coating for our hydrogen sulfide storage tank, the corrosion of which we have been unable to stop by any of the usual methods.

THE DIFFERENCE BETWEEN THE HALF SUM AND THE SQUARE ROOT OF THE PRODUCT WHEN WEIGHING BY THE METHOD OF GAUSS*

S. F. HOWARD AND T. A. MARTIN, NORTHFIELD UNIVERSITY, NORWICH, VT.

For the calibration of weights the method of Gauss is usually recommended. As the calculations at best are long, any device for shortening the computation should be welcomed by those who calibrate their weights from time to time or who wish to weigh by the exact method of Gauss.

If we use the decimal place next beyond that of the sensitivity of the balance we often have to deal with numbers having five or six digits. To multiply these and to extract the square root involve time and care. The use of logarithms simplifies matters somewhat but there is almost always an interpolation to cover three digits, at least, and the third digit cannot be very accurate with the common tables.

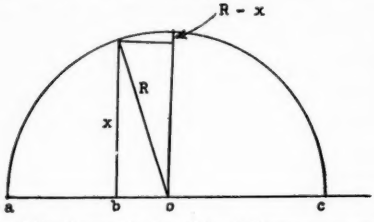
If the arms of the balance are the same length the two weights will be the same and the square root of the product will equal one half of the sum. If the arms are unequal the half sum will be greater than the square root of the product. The greater the differences in the lengths of the arms the more will these values differ.

It is the magnitude of this difference which we are considering. Morse in his "Exercises in Quantitative Chemistry," says that the half sum may be

* Read in the Division of Chemical Education of the American Chemical Society, at the Washington Meeting, April 24, 1924.

used when this difference "is too small to be detected by the balance." It is our purpose to derive a formula which may be used to tell when this difference is so small that the half sum may be used and correct weights obtained within the limitations of the balance.

Consider a semicircle with the diameter equal to the sum of the weights. If *ac* is the diameter, then *ab* and *ac* are the weights W_1 and W_2. When these weights are equal the radius, R, represents the true weight. When the weights are unequal, x, the perpendicular at *b*, cutting the circumference, represents the true weight. $R - x$ is the difference between the half sum and the square root of the product.



The formula for this difference or error, is derived as follows:

$$x = \sqrt{W_1 W_2} \tag{1}$$

$$R = \frac{W_1 + W_2}{2} \tag{2}$$

$$R - x = \frac{W_1 + W_2}{2} - \sqrt{W_1 W_2} \tag{3}$$

$$R^2 = (R - W_1)^2 + x^2 \tag{4}$$

$$R^2 - x^2 = (R - W_1)^2 \tag{5}$$

$$R - x = \frac{(R - W_1)^2}{R + x} \tag{6}$$

$$R - W_1 = \frac{W_1 + W_2}{2} - W_1 = \frac{W_2 - W_1}{2} \tag{7}$$

As the difference between W_1 and W_2 grows smaller x approaches R as a limit. Since the formula is to be used when the two weights differ very little, $R + x$ may be written as $2R$.

Hence,
$$R - x = \frac{\left(\frac{W_2 - W_1}{2}\right)^2}{2R} = \frac{(W_2 - W_1)^2}{4(W_1 + W_2)} \tag{8}$$

The table has been worked out by the formula for weights differing from one-fourth to five per cent and shows the difference or error for each per cent indicated. The smaller weight is taken as 1.00.

Weights differ %	Error by formula	Per cent error
0.25	0.00000078	0.00008
.5	.000003	.0003
1.00	.00001244	.00125
2.00	.0000495	.005
3.00	.000111	.01
4.00	.000196	.02
5.00	.000305	.03

From the table it is evident that the half sum may be used if the arms, or weights, differ by one-fourth of a per cent with an error of only eight one hundred thousandths of one per cent. If they vary by one per cent the error is $^1/_{800}$ of a per cent, while a difference in the arms of five per cent involves an error of $^1/_{33}$ of a per cent.

If the half sum is used when the error is well below the limitations of the balance, it will be found that much time is saved with no loss in accuracy.

THE TEACHER'S VOW

I will see the good in all pupils and lead them on to higher attainments.

I will be patient and forebearing, confident in the belief that kindness and generosity will ultimately triumph.

I will scorn error, deceit, and all forms of falsehood, persistently foregoing sarcasm and injustice.

I will claim all nature as my heritage and spend a portion of each day quietly in God's open air.

I will hold daily communion with my own soul.

I will accept my remuneration, however small, without envy, complaint or discouragement, never forgetting that a teacher is a leader into the higher life, and not merely a wage earner.

I will work each day in unshaken assurance that peace and power come in full measure to all who are ready for the truth.

LYMAN C. NEWELL

Local Activities and Opportunities

St John's College. The Department of Chemistry of St. John's College has been completely reorganized and new laboratories have been installed. The staff consists of Colin M. Mackall, Professor; Gilbert B. L. Smith, Asst. Professor; and George W. Cassell, Instructor.

Colin M. Mackall, (Ph.D. Johns Hopkins) formerly Professor of Chemistry at the University of the South, Chemist, Edgewood Arsenal, and for two years American Field Service Fellow at the College de France.

Gilbert B. L. Smith (Ph.D. Cornell), formerly Asst. in Chemistry at the University of Wisconsin and Heckscher Research Fellow in Inorganic Chemistry at Cornell University.

George W. Cassell (B.S. Chem. Virginia) formerly Assistant in Chemistry at the University of Virginia.

University of Wisconsin. Chemistry is the handmaid of the other sciences. This fact has been demonstrated at the University of Wisconsin where, out of 1386 registrations in 1923 in the four basic courses in Chemistry—General, Analytical, Organic and Physical—in the Department of Chemistry, 89 per cent were students who were specializing in Agriculture, Commerce, Medicine, Physical Education, Engineering, Home Economics and Pharmacy.

New Appointments for 1924-25

Instructors

General Chemistry

J. R. Lewis, Ph.D	Wisconsin
E. L. Whitford, Ph.D.	Wisconsin

Organic Chemistry

M. W. Klein, Ph.D.	Wisconsin

Assistants

Analytical Chemistry

A. G. Fruehan, B.S.	Pennsylvania State
G. Hoffman, B.S.	Wisconsin
H. Schrank, B.S.	Akron

General Chemistry

W. H. Bennett, A.B.	Ohio State
A. S. Carter, B.S.	Carnegie Institute
C. J. Christensen, B.S.	Young University
G. W. Filson, A.B.	Kansas
E. M. Fitchett, B.S.	Wisconsin
F. W. Laird, B.S.	British Columbia
D. W. MacCorquodale, B. S.	Illinois
G. T. Parker, B.S.	Lombard College
R. B. Reynolds, B.S.	Alabama Polytechnic
R. M. Simington, B.S.	Oregon Agricultural College
C. H. Sorum, B.A.	St. Olaf's College
R. N. Traxler, M.S.	Colorado
L. S. Ward, M.A.	Colorado

Organic Chemistry

G. M. Buffett, M.S.	Nebraska
R. F. Korfhage, B.S.	Minnesota
J. N. Street, M.S.	Syracuse

New England Association of Chemistry Teachers. On Saturday, November 15, the N. E. A. C. T. held their eighty-ninth meeting at Tufts College, where the following program was given:

Program

9.45 Meeting of the Executive Committee in the Library.

10.00 Address of Welcome.
Dr. Frank W. Durkee, Tufts College.

10.10 Business Meeting.
Election of New Members.
Reports of Standing Committees, Central Division.
a. New Apparatus Committee, Grover C. Greenwood, Chairman.
b. Industrial Trips Committee, Mary B. Ford, Chairman.
c. New Books Committee, Charles H. Stone, Chairman.
d. Current Events Committee, Eva B. Ammidown, Chairman.

10.40 Address: "How the American Chemical Society can coöperate with the N. E. A. C. T." Dr. Neil E. Gordon, University of Maryland.
Discussion by Dr. Lyman C. Newell and Mr. Wilhelm Segerblom.

11.10 Address: "Some Local Contributions Toward the Development of Organic Chemistry as a Science." Dr. David Worrall, Prof. of Organic Chemistry, Tufts College.

11.50 Annual Reports; Election of Officers.
a. Report of the Secretary.
b. Report of the Assistant Secretary.
c. Report of the Treasurer.
d. Report of the Nominating Committee and Election of Officers for 1924–1925.

12.15 Inspection of the New Tufts Chemical Laboratory.
The work of this department of the College was outlined by members of the instruction and research staff.

1.15 Lunch at the College Cafeteria.

Ohio Chemistry Teachers Association. The Chemistry teachers of Northeastern Ohio met in Cleveland, October 24th at a luncheon held at Central Y. M. C. A. At this meeting C. W.

Fretz, Head of the Chemistry Department at McKinley High School, Canton, talked on "The possibilities of the New Journal of Chemical Education in High School Teaching." Miss J. C. Bennett of East High, Cleveland, read a paper on "What Next in Chemistry Teaching." Dr. H. N. Holmes of Oberlin College, gave a plan for the organization of the Ohio State Chemistry Teachers under the auspices of the American Chemical Society. The 56 teachers present gave their unanimous approval and pledged their support to the new organization.

On December 13th the Chemistry teachers of Northeastern Ohio, will meet at Central Y. M. C. A. at 10 A. M. to outline a plan for research on various lines of chemical educational work.

The committee on arrangements for this meeting will consist of K. M. Persing of Glenville High School, Cleveland, C. E. Fleming, Sandusky High, Sandusky, Ohio, and M. V. McGill, Lorain High School, Lorain, Ohio.

Maryland Association of Chemistry Teachers. On Friday, November 28th, the Maryland Association of Chemistry Teachers will meet at the Forest Park High School, Baltimore, Md., where the following program will be given:

Program

1. "Across France with a Chemist," Colin M. Mackall, St. John's College, Annapolis, Maryland.
2. "The Use of Exhibits in Teaching," H. C. Wickard, Cumberland, Maryland.
3. "The Value of Local Section Meetings of the American Chemical Society to Chemistry Teachers," Leslie Ingham, Baltimore City College, Baltimore, Maryland.
4. "Prospects in Chemical Education," Neil E. Gordon, University of Maryland, College Park, Maryland.
5. Business Meeting.

George Washington University. On Saturday, November 29, at 9.15 A. M., the Science Section of the Association of Colleges and Preparatory Schools of the Middle States and Maryland will hold its fourth annual meeting at George Washington University where the following program will be given:

Program

1. "Science Tests: The New Type versus the Old Type." Mr. Leighton K. Smith, Department of Chemistry, Wilmington High School, Wilmington, Delaware.
2. "The Teachers Relation to Research." Dr. E. A. Eckhardt, Physicist, Bureau of Standards, Washington, D. C.
3. "A College Course for Stuents with High School Training in Chemistry." Miss Quaesita C. Drake, Professor of Chemistry, Women's College, University of Delaware, Newark, Delaware.

Address: "Chemistry in Our National Life." General Amos A. Fries, U. S. Army, Washington, D. C.
Questions and General Discussion will follow the address.

Business Meeting: Reports of Committees.
Election of Officers.
Discussion of revision of the Constitution of the Section.

Meetings of the Council and of newly appointed committees to discuss plans for the next year.

Carnegie Institute. The Langley Association of Science Teachers of Western Pennsylvania held its fall meeting in connection with the Western Pennsylvania Education Association in Pittsburgh, Oct. 24, 1924. At 6.30 P. M. dinner was served in the dining room of the Carnegie Institute to about one hundred members of the Langley Association. Immediately after the dinner a social and business meeting was held. At this meeting Dr. W. M. Davidson, Superintendent of the Schools of Pittsburgh spoke on the value of science instruction in the public schools. Prof. Alexander Silverman of the University of Pittsburgh presented the offer of the American Chemical Society of $4.50 for membership in the Pittsburgh Section of the A. C. S. and in the Division of Chemical Education, and for one year's subscription to the Journal of Chemical Education. This offer was very warmly received and the probability is that many of the members will take advantage of it.

At 8.30 the association adjourned to the lecture hall of the Carnegie Institute where a most interesting public meeting was held. A humorous film by Buster Keaton, "The Electrical House," was shown. After this Prof. John Mills of the Western Electric Co. of New York showed the new film put out by that company entitled "The Electrical Transmission of Speech." The chief event of the evening was a most scholarly and interesting lecture by Professor Mills on "Within the Atom." Officers of the Langley Association of Science Teachers are:

President—C. C. Dunning, Peabody H. S., Pittsburgh, Pa.

Vice-President—E. O. Morrison, Coraopolis, Pa., H. S.

Treasurer—C. E. Baer, Butler, Pa., H. S.

Secretary—F. G. Masters, Fifth Avenue, H. S., Pittsburgh, Pa.

University of Illinois. Elizabeth C. Hyde formerly of the Inorganic Division, of the University of Illinois is instructor of Organic and Physiological Chemistry, at Wells College, Aurora, New York.

E. O. North, who received his Ph.D. from the University of Illinois this summer is teaching chemistry at Knox College, Galesburg, Illinois. J. W. Kern, also Ph.D., 1924 is teaching at Union College, Schenectady, New York.

C. W. Rodewald of the Chemistry Department, of the University of Nebraska, received his Ph.D., this summer at this University.

Recent Books

Chemical Synthesis. By HARRY HEPWORTH. D. Van Nostrand Company, New York, 1924. xx. 243 pages. $6.50.

Dr. Hepworth's book presents an admirable discussion of the achievements of the organic chemist in the synthesis of naturally occurring compounds. It is a book which can be read with profit by anyone familiar with, and interested in, organic chemistry.

"Chemical Synthesis" might well be used as a hand book in a graduate course in special topics in organic chemistry. Those who believe that the reactions of organic chemistry can best be presented to advanced students by means of examples of their application will find this book a veritable gold mine of valuable information.

The physical make-up of the book, with the exception of a few details, is excellent. There are a few typographical errors in some of the structural formulae, which might lead the inexperienced into difficulty. Unfortunately, the book is not bound as strongly as might be desired. It is to be hoped that publishers will more generally be brought to a realization of the desirability of strong binding, so that our technical books may withstand ordinary usage.

JOHN H. GARDNER

Elementary Qualitative Analysis. By J. H. REEDY. McGraw-Hill Book Co., New York, 1924. xiv + 137 pp. Price $1.50.

"This book is an attempt to put in printed form the system of laboratory and quiz room instruction that has been developed during recent years in the elementary courses in Qualitative Analysis at the University of Illinois. It presumes that the student has had the equivalent of not less than five semester hours of college chemistry. . . . The fundamental purpose in the compilation of this manual has been to enable the student to know at all times exactly what he is doing. . . . The endeavor has been made to put nothing in the book that the elementary student might not be expected to understand" (preface).

The procedures for the detection of cations are, for the most part, the customary ones. Ammonium polysulfide is used in separating the copper and tin subgroups, and sodium peroxide for the separation of the aluminium and iron subgroups. As an alternative procedure, an innovation in qualitative analysis is found in the use of oxalic acid and hydrogen peroxide in separating tin from arsenic and antimony. A new procedure is inserted in the iron-group analysis for the purpose of destroying oxalates. Alternative procedures are given for the separation of calcium and strontium, the first depending upon the separation of strontium as sulfate, and the second upon the precipitation of calcium as ferrocyanide. "The general scheme for the detection of the anions is, with certain changes, the one worked out by this writer and published in the seventh edition of W. A. Noyes 'Qualitative Analysis'."

The plan of instruction provides, first, for adequate preliminary tests on the members of a group, with notes as required, followed by a set of exercises for use in quizroom work. The analysis of the group follows, with additional notes on the procedures. The student works through the book without skipping until the complete analysis is taken up. This is a pedagogical advantage.

The procedures are clearly given and the notes make mention of numerous pitfalls which every teacher knows but few texts recognize. Throughout the book there are improvements in the small points of technique, and a fine emphasis upon details. There is no attempt, however, to distinguish *quantities* of the constituents, other than traces.

The reviewer noted about fifteen typographical errors. The statements that cobaltic hydroxide may remain in the iron group as a residue insoluble in nitric acid (like manganese, p. 49), and that fusion with potassium pyrosulfate converts chromic oxide into the chromate (p. 114) are contrary to the reviewer's experience.

On the whole, the book appears to be the best of its kind, for use with first-year students. Personally, the reviewer believes that more can be accomplished if qualitative analysis is postponed until a later stage in the student's career, when a more precise type of procedure may be employed.

G. H. CARTLEDGE